CLAIMS

What is claimed is:

1. An apparatus that provides a radio frequency energy to a probe placed in contact with a cornea to perform a medical procedure, comprising:

a radio frequency circuit that delivers a radio frequency energy to the cornea through the probe; and,

a regulator circuit that controls the radio frequency energy delivered to the cornea during the medical procedure.

2. The apparatus of claim 1, further comprising a sensing circuit that senses a change in a physiology of the cornea during the medical procedure and provides a feedback to said regulator circuit.

3. The apparatus of claim 2, wherein said sensing circuit senses a current delivered to the cornea.

4. The apparatus of claim 2, wherein said sensing circuit senses a voltage delivered to the cornea.

5. The apparatus of claim 2, wherein said sensing circuit senses a temperature of the cornea.

6. The apparatus of claim 2, wherein said sensing circuit senses an impedance of the cornea.

7. The apparatus of claim 2, wherein said sensing circuit senses a moisture of the cornea.

8. The apparatus of claim 1, wherein said regulator circuit controls the delivery of the radio frequency energy about a set-point.

9. The apparatus of claim 1, wherein said regulator circuit controls the delivery of the radio frequency energy about a set-curve.

10. The apparatus of claim 2, wherein said regulator circuit determines a profile of a physiological parameter

and regulates the radio frequency energy delivered to the cornea in accordance with the profile.

11. The apparatus of claim 10, wherein the profile is an impedance profile.

12. The apparatus of claim 10, wherein the profile is a temperature profile.

13. The apparatus of claim 10, wherein the profile is a moisture profile.

14. The apparatus of claim 10, wherein said regulator circuit decreases the radio frequency energy if the profile includes an increase in impedance beyond a threshold level during the medical procedure.

15. The apparatus of claim 10, wherein said regulator circuit terminates delivery of the radio frequency energy if the profile exceeds a threshold level during the medical procedure.

16. The apparatus of claim 10, wherein said regulator circuit terminates delivery of the radio frequency energy if the profile includes a slope that exceeds a threshold level during the medical procedure.

17. The apparatus of claim 16, wherein said regulator circuit modulates a duration of the delivery of the radio frequency energy.

18. The apparatus of claim 17, wherein said duration is modulated in response to changes in a profile of the physiological parameter.

19. The apparatus of claim 18, wherein the physiological parameter is an impedance.

20. The apparatus of claim 18, wherein the physiological parameter is a temperature.

21. The apparatus of claim 18, wherein the physiological parameter is a tissue moisture.

22. The apparatus of claim 1, wherein said regulator circuit modulates a level of the radio frequency energy.

23. An apparatus that provides a radio frequency energy to a probe placed in contact with a cornea to perform a medical procedure, comprising:

a radio frequency circuit that delivers a radio frequency energy to the cornea through the probe; and,

regulator circuit means for controlling the radio frequency energy delivered to cornea during the medical procedure.

24. The apparatus of claim 23, further comprising sensing circuit means for sensing a change in a physiology of the cornea during the medical procedure and providing a feedback to said regulator circuit.

25. The apparatus of claim 24, wherein said sensing circuit means senses a current delivered to the cornea.

26. The apparatus of claim 24, wherein said sensing circuit means senses a voltage delivered to the cornea.

27. The apparatus of claim 24, wherein said sensing circuit means senses a temperature of the cornea.

28. The apparatus of claim 24, wherein said sensing circuit means senses an impedance of the cornea.

29. The apparatus of claim 24, wherein said sensing circuit means senses a moisture of the cornea.

30. The apparatus of claim 23, wherein said regulator circuit means controls the delivery of the radio frequency energy about a set-point.

31. The apparatus of claim 23, wherein said regulator circuit means controls the delivery of the radio frequency energy about a set-curve.

32. The apparatus of claim 24, wherein said regulator circuit means determines a profile of a physiological

parameter and regulates the radio frequency energy delivered to the cornea in accordance with the profile.

33. The apparatus of claim 32, wherein the profile is an impedance profile.

34. The apparatus of claim 32, wherein the profile is a temperature profile.

35. The apparatus of claim 32, wherein the profile is a moisture profile.

36. The apparatus of claim 32, wherein said regulator circuit means decreases the radio frequency energy if the profile includes an increase in impedance beyond a threshold level during the medical procedure.

37. The apparatus of claim 32, wherein said regulator circuit means terminates delivery of the radio frequency energy if the profile exceeds a threshold level during the medical procedure.

38. The apparatus of claim 32, wherein said regulator circuit means terminates delivery of the radio frequency energy if the profile includes a slope that exceeds a threshold level during the medical procedure.

39. The apparatus of claim 23, wherein said regulator circuit means modulates a duration of the delivery of the radio frequency energy.

40. The apparatus of claim 39, wherein said duration is modulated in response to changes in a profile of the physiological parameter.

41. The apparatus of claim 40, wherein the physiological parameter is an impedance.

42. The apparatus of claim 40, wherein the physiological parameter is a temperature.

43. The apparatus of claim 40, wherein the physiological parameter is a tissue moisture.

44. The apparatus of claim 23, wherein said regulator circuit means modulates a level of the radio frequency energy.

45. A method for performing a medical procedure on a cornea, comprising:

placing a probe in contact with a cornea;

delivering a radio frequency energy to the cornea through the probe; and,

regulating the radio frequency energy delivered to cornea during the medical procedure.

46. The method of claim 45, further comprising sensing and feeding back a change in a physiology of the cornea during the medical procedure and regulating the radio frequency energy delivered to the cornea as a function of the feedback.

47. The method of claim 46, wherein a current delivered to the cornea is sensed during the medical procedure.

48. The method of claim 46, wherein a voltage delivered to the cornea is sensed during the medical procedure.

49. The method of claim 46, wherein a temperature of the cornea is sensed during the medical procedure.

50. The method of claim 46, wherein an impedance of the cornea is sensed during the medical procedure.

51. The method of claim 46, wherein said a moisture of the cornea is sensed during the medical procedure.

52. The method of claim 45, wherein the radio frequency energy is regulated about a set-point.

53. The method of claim 45, wherein the radio frequency energy is regulated about a set-curve.

54. The method of claim 46, wherein a profile of a physiological parameter is determined and the radio

frequency energy delivered to the cornea is regulated in accordance with the profile.

55. The method of claim 54, wherein the profile is an impedance profile.

56. The method of claim 54, wherein the profile is a temperature profile.

57. The method of claim 54, wherein the profile is a moisture profile.

58. The method of claim 54, wherein regulating includes decreasing the radio frequency energy if the profile includes an increase in impedance beyond a threshold level during the medical procedure.

59. The method of claim 54, wherein regulating includes terminating delivery of the radio frequency energy if the profile exceeds a threshold level during the medical procedure.

60. The method of claim 54, wherein regulating includes terminating delivery of the radio frequency energy if the profile includes a slope that exceeds a threshold level during the medical procedure.

61. The method of claim 45, wherein regulating includes modulating a duration of the delivery of the radio frequency energy.

62. The method of claim 61, wherein the duration is modulated in response to changes in a profile of the physiological parameter.

63. The method of claim 61, wherein the physiological parameter is an impedance.

64. The method of claim 61, wherein the physiological parameter is a temperature.

65. The method of claim 61, wherein the physiological parameter is a tissue moisture.

66. The method of claim 45, wherein regulating includes modulating a level of the radio frequency energy.

67. An apparatus that provides a radio frequency energy to a probe placed in contact with a cornea to perform a medical procedure, comprising:

a radio frequency circuit that delivers a radio frequency energy to the cornea through the probe; and,

a sensing circuit that senses a change in a physiology of the cornea while said radio frequency circuit delivers the radio frequency energy to the cornea.

68. The apparatus of claim 67, wherein said sensing circuit senses a current delivered to the cornea.

69. The apparatus of claim 67, wherein said sensing circuit senses a voltage delivered to the cornea.

70. The apparatus of claim 67, wherein said sensing circuit senses a temperature of the cornea.

71. The apparatus of claim 67, wherein said sensing circuit senses an impedance of the cornea.

72. The apparatus of claim 67, wherein said sensing circuit senses a moisture of the cornea.

73. An apparatus that provides a radio frequency energy to a probe placed in contact with a cornea to perform a medical procedure, comprising:

a radio frequency circuit that delivers a radio frequency energy to the cornea through the probe; and,

sensing means for sensing a change in a physiology of the cornea while said radio frequency circuit delivers the radio frequency energy delivered to the cornea.

74. The apparatus of claim 73, wherein said sensing means senses a current delivered to the cornea.

75. The apparatus of claim 73, wherein said sensing means senses a voltage delivered to the cornea.

76. The apparatus of claim 73, wherein said sensing means senses a temperature of the cornea.

77. The apparatus of claim 73, wherein said sensing means senses an impedance of the cornea.

78. The apparatus of claim 73, wherein said sensing means senses an impedance of the cornea.

79. A method for performing a medical procedure on a cornea, comprising:

placing a probe in contact with a cornea;

delivering a radio frequency energy to the cornea through the probe; and,

sensing a change in a physiology of the cornea while the radio frequency energy is delivered to the cornea.

80. The method of claim 79, wherein a current delivered to the cornea is sensed while the radio frequency energy is delivered to the cornea.

81. The method of claim 79, wherein a voltage delivered to the cornea is sensed while the radio frequency energy is delivered to the cornea.

82. The method of claim 79, wherein an impedance of the cornea is sensed while the radio frequency energy is delivered to the cornea.

83. The method of claim 79, wherein a temperature of the cornea is sensed while the radio frequency energy is delivered to the cornea.

84. The method of claim 79, wherein a moisture of the cornea is sensed while the radio frequency energy is delivered to the cornea.

85. An apparatus that provides a non-thermal energy to a cornea through a probe to perform a medical procedure that denatures collagen tissue and reshapes the cornea, comprising:

an energy circuit that delivers a non-thermal energy to the cornea through the probe; and,

a regulator circuit that controls the non-thermal energy delivered to the cornea during the medical procedure.

86. The apparatus of claim 85, wherein the non-thermal energy is in a microwave frequency range.

87. The apparatus of claim 85, wherein the non-thermal energy is in an ultrasonic frequency range.

88. The apparatus of claim 85, wherein the non-thermal energy is light.

89. The apparatus of claim 85, wherein the non-thermal energy is direct current.

90. The apparatus of claim 85, further comprising a sensing circuit that senses a change in a physiology of the cornea during the medical procedure and provides a feedback to said regulator circuit.

91. The apparatus of claim 90, wherein said sensing circuit senses a current delivered to the cornea.

92. The apparatus of claim 90, wherein said sensing circuit senses a voltage delivered to the cornea.

93. The apparatus of claim 90, wherein said sensing circuit senses a temperature of the cornea.

94. The apparatus of claim 90, wherein said sensing circuit senses an impedance of the cornea.

95. The apparatus of claim 90, wherein said sensing circuit senses an optical characteristic of the cornea.

96. The apparatus of claim 85, wherein said regulator circuit controls the delivery of the non-thermal energy about a set-point.

97. The apparatus of claim 85, wherein said regulator circuit controls the delivery of the non-thermal energy about a set-curve.

98. The apparatus of claim 90, wherein said regulator circuit determines a profile of a physiological parameter

and regulates the non-thermal energy delivered to the cornea in accordance with the profile.

99. The apparatus of claim 98, wherein said regulator circuit decreases the non-thermal energy if the profile displays changes indicative of necrotic collagen structural modification beyond a threshold level during the medical procedure.

100. The apparatus of claim 98, wherein said regulator circuit terminates delivery of the non-thermal energy if the profile exceeds a threshold level during the medical procedure.

101. The apparatus of claim 98, wherein said regulator circuit terminates delivery of the non-thermal energy if the profile includes a slope that exceeds a threshold level during the medical procedure.

102. The apparatus of claim 85, wherein said regulator circuit modulates a duration of the delivery of the non-thermal energy.

103. The apparatus of claim 85, wherein said regulator circuit modulates a level of the non-thermal energy.

104. An apparatus that provides a non-thermal energy to a cornea through a probe to perform a medical procedure that denatures collagen tissue and reshapes the cornea, comprising:

an energy circuit that delivers a non-thermal energy to the cornea through the probe; and,

regulator circuit means for controlling the non-thermal energy delivered to cornea during the medical procedure.

105. The apparatus of claim 104, wherein the non-thermal energy is in a microwave frequency range.

106. The apparatus of claim 104, wherein the non-thermal energy is in an ultrasonic frequency range.

107. The apparatus of claim 104, wherein the non-thermal energy is light.

108. The apparatus of claim 104, wherein the non-thermal energy is direct current.

109. The apparatus of claim 104, further comprising sensing circuit means for sensing a change in a physiology of the cornea during the medical procedure and providing a feedback to said regulator circuit.

110. The apparatus of claim 109, wherein said sensing circuit means senses a current delivered to the cornea.

111. The apparatus of claim 109, wherein said sensing circuit means senses a voltage delivered to the cornea.

112. The apparatus of claim 109, wherein said sensing circuit means senses a temperature of the cornea.

113. The apparatus of claim 109, wherein said sensing circuit means senses an impedance of the cornea.

114. The apparatus of claim 109, wherein said sensing circuit means senses an optical characteristic of the cornea.

115. The apparatus of claim 104, wherein said regulator circuit means controls the delivery of the non-thermal energy about a set-point.

116. The apparatus of claim 104, wherein said regulator circuit means controls the delivery of the non-thermal energy about a set-curve.

117. The apparatus of claim 109, wherein said regulator circuit means determines a profile of a physiological parameter and regulates the non-thermal energy delivered to the cornea in accordance with the profile.

118. The apparatus of claim 117, wherein said regulator circuit means decreases the non-thermal energy if the profile displays changes indicative of necrotic collagen structural modification beyond a threshold level during the medical procedure.

119. The apparatus of claim 114, wherein said regulator circuit means terminates delivery of the non-thermal energy if the profile exceeds a threshold level during the medical procedure.

120. The apparatus of claim 114, wherein said regulator circuit means terminates delivery of the non-thermal energy if the profile includes a slope that exceeds a threshold level during the medical procedure.

121. The apparatus of claim 104, wherein said regulator circuit means modulates a duration of the delivery of the non-thermal energy.

122. The apparatus of claim 104, wherein said regulator circuit modulates a level of the non-thermal energy.

123. A method for performing a medical procedure on a cornea, comprising:

contacting a cornea with a probe;

delivering a non-thermal energy to the cornea through the probe to denature collagen tissue and reshape the cornea; and,

regulating the non-thermal energy delivered to cornea during the medical procedure.

124. The method of claim 123, wherein the non-thermal energy is in a microwave frequency range.

125. The method of claim 123, wherein the non-thermal energy is in an ultrasonic frequency range.

126. The method of claim 123, wherein the non-thermal energy is light.

127. The method of claim 123, wherein the non-thermal energy is direct current.

128. The method of claim 123, further comprising sensing a change in a physiology of the cornea during the medical procedure and regulating the non-thermal energy delivered to the cornea as a function of the feedback.

129. The method of claim 128, wherein a current delivered to the cornea is sensed during the medical procedure.

130. The method of claim 128, wherein a voltage delivered to the cornea is sensed during the medical procedure.

131. The method of claim 128, wherein a temperature of the cornea is sensed during the medical procedure.

132. The method of claim 128, wherein an impedance of the cornea is sensed during the medical procedure.

133. The method of claim 128, wherein an optical characteristic of the cornea is sensed during the medical procedure.

134. The method of claim 123, wherein the non-thermal energy is regulated about a set-point.

135. The method of claim 123, wherein the non-thermal energy is regulated about a set-curve.

136. The method of claim 128, wherein a profile of a physiological parameter is determined and the non-thermal energy delivered to the cornea is regulated in accordance with the profile.

137. The method of claim 136, wherein regulating includes decreasing the non-thermal energy if the profile displays changes indicative of necrotic collagen structural modification beyond a threshold level during the medical procedure.

138. The method of claim 136, wherein regulating includes terminating delivery of the non-thermal energy if the profile exceeds a threshold level during the medical procedure.

139. The method of claim 136, wherein regulating includes terminating delivery of the non-thermal energy if

the profile includes a slope that exceeds a threshold level during the medical procedure.

140. The method of claim 123, wherein regulating includes modulating a duration of the delivery of the non-thermal energy.

141. The method of claim 123, wherein regulating includes modulating a level of the non-thermal energy.

142. An apparatus that provides a non-thermal energy to a cornea through a probe to perform a medical procedure that denatures collagen tissue and reshapes the cornea, comprising:

a energy circuit that delivers a non-thermal energy to the cornea through the probe; and,

a sensing circuit that senses a change in a physiology of the cornea while said energy circuit delivers the non-thermal energy to the cornea.

143. The apparatus of claim 142, wherein the non-thermal energy is in a microwave frequency range.

144. The apparatus of claim 142, wherein the non-thermal energy is in an ultrasonic frequency range.

145. The apparatus of claim 142, wherein the non-thermal energy is light.

146. The apparatus of claim 142, wherein the non-thermal energy is direct current.

147. The apparatus of claim 142, wherein said sensing circuit senses a current delivered to the cornea.

148. The apparatus of claim 142, wherein said sensing circuit senses a voltage delivered to the cornea.

149. The apparatus of claim 142, wherein said sensing circuit senses a temperature of the cornea.

150. The apparatus of claim 142, wherein said sensing circuit senses an impedance of the cornea.

151. The apparatus of claim 142, wherein said sensing circuit senses an optical characteristic of the cornea.

152. An apparatus that provides a non-thermal energy to a cornea through a probe to perform a medical procedure to denature collagen tissue and reshape the cornea, comprising:

an energy circuit that delivers a non-thermal energy to the cornea through the probe; and,

sensing means for sensing a change in a physiology of the cornea while said energy circuit delivers the non-thermal energy delivered to the cornea.

153. The apparatus of claim 152, wherein the non-thermal energy is in a microwave frequency range.

154. The apparatus of claim 152, wherein the non-thermal energy is in an ultrasonic frequency range.

155. The apparatus of claim 152, wherein the non-thermal energy is light.

156. The apparatus of claim 152, wherein the non-thermal energy is direct current.

157. The apparatus of claim 152, wherein said sensing means senses a current delivered to the cornea.

158. The apparatus of claim 152, wherein said sensing means senses a voltage delivered to the cornea.

159. The apparatus of claim 152, wherein said sensing means senses a temperature of the cornea.

160. The apparatus of claim 152, wherein said sensing means senses an impedance of the cornea.

161. The apparatus of claim 152, wherein said sensing means senses an optical characteristic of the cornea.

162. A method for performing a medical procedure on a cornea, comprising:

contacting a cornea with a probe;

delivering a non-thermal energy to the cornea through the probe; and,

sensing a change in a physiology of the cornea while the non-thermal energy is delivered to the cornea.

163. The method of claim 162, wherein the non-thermal energy is in a microwave frequency range.

164. The method of claim 162, wherein the non-thermal energy is in an ultrasonic frequency range.

165. The method of claim 162, wherein the non-thermal energy is light.

166. The method of claim 162, wherein the non-thermal energy is direct current.

167. The method of claim 162, wherein a current delivered to the cornea is sensed while the non-thermal energy is delivered to the cornea.

168. The method of claim 162, wherein a voltage delivered to the cornea is sensed while the non-thermal energy is delivered to the cornea.

169. The method of claim 162, wherein a temperature of the cornea is sensed while the non-thermal energy is delivered to the cornea.

170. The method of claim 162, wherein an optical characteristic of the cornea is sensed while the non-thermal energy is delivered to the cornea.